CLAIMS

1. Apparatus for removing material from a workpiece, said apparatus comprising:

an abrasive wheel having an abrasive circumferential surface and rotatable about a first axis passing through a centre thereof, and mounted to orbit about a second axis spaced from the first axis;

means for effecting relative advancing movement between the second axis and the workpiece to remove material from the workpiece;

means for detecting a load applied to said wheel by said workpiece; and

means for controlling the rate of the advancing movement depending on the magnitude of the detected load.

2. Apparatus according to Claim 1, wherein the detecting means comprises means for monitoring a current drawn to move the abrasive surface of the wheel relative to the workpiece.

3. Apparatus according to Claim 1 or 2, wherein the detecting means comprises means for monitoring a current drawn to rotate the wheel.

4. Apparatus according to Claim 2 or 3, wherein the control means is arranged to reduce the rate of the advancing movement when said current is greater than a predetermined value.

5. Apparatus according to any preceding claim, wherein the control means is arranged to reverse said advancing movement when said detected load is greater than a predetermined value for a predetermined period of time.

6. Apparatus for removing material from a workpiece, said apparatus comprising:

an abrasive wheel having an abrasive circumferential surface and rotatable about a first axis passing through a centre thereof, and mounted to orbit about a second axis spaced from the first axis;

means for effecting relative advancing movement of the second axis towards

the workpiece to remove material from the workpiece;

means for detecting a load applied to the wheel by the workpiece; and

means for controlling said moving means to reverse the advancing movement when the detected load is greater than a predetermined value for a predetermined period of time.

7. Apparatus according to Claim 5 or 6, wherein the control means is arranged to subsequently re-effect the relative advancing movement between the second axis and the workpiece when said detected load falls below a predetermined value.

8. Apparatus according to any preceding claim, wherein said control means comprises means for monitoring the magnitude of the detected load during the removal of material at each of a plurality of spaced positions along the workpiece.

9. Apparatus according to Claim 8, wherein the control means is arranged to control the positioning of the wheel in preparation for the removal of material from one of said spaced positions in response to wear of the wheel during the previous removal of material from at least two of said spaced positions.

10. Apparatus according to Claim 9, wherein the monitoring means is arranged to detect the extent of the wear of the wheel from the relative positions of the wheel when contact is first made with the workpiece during said previous removal of material.

11. Apparatus according to Claim 9 or 10, wherein the monitoring means is arranged to detect the extent of the wear of the wheel from the relative positions of the wheel when load applied to the wheel is first detected during said previous removal of material.

12. Apparatus for positioning a tool in preparation for the removal of material from a workpiece, said apparatus comprising means for controlling the position of the tool in preparation for the removal of material from one of a plurality of spaced positions

along the workpiece in response to wear of the tool as determined during the previous removal of material from at least two spaced positions along the workpiece.

13. Apparatus according to Claim 12, comprising means for detecting the load on the tool during the removal of material from said spaced positions along the workpiece, said control means being arranged to control the position of the tool in preparation for the removal of material from one of said spaced positions in response to wear of the tool as determined from the relative positions of the tool when load applied to the tool is first detected during said previous removal of material.

14. Apparatus according to any of Claims 12 to 13, comprising means for rotating said tool about an axis.

15. Apparatus according to Claim 14, wherein said tool comprises an abrasive wheel.

16. Apparatus according to Claim 15, comprising means for orbiting the wheel about a second axis spaced from said first-mentioned axis, and means for moving said second axis relative to the workpiece to bring a circumferential edge of the wheel into contact with the workpiece.

17. Apparatus according to any of Claims 5 to 7 or Claim 16, wherein said predetermined period of time is at least one third of the time taken for the wheel to perform a full orbit of the second axis.

18. Apparatus according to Claim 16 or 17, wherein the control means is arranged to decrease the area of contact between the wheel and the workpiece by decreasing said rate of advancing movement.

19. A method of removing material from a workpiece, said method comprising the steps of:

rotating an abrasive wheel having an abrasive circumferential surface about a

first axis passing through a centre thereof;

orbiting the wheel about a second axis spaced from the first axis;

effecting relative advancing movement between the second axis and the workpiece to remove material from the workpiece;

detecting a load applied to said wheel by said workpiece; and

controlling the rate of the advancing movement depending on the magnitude of the detected load.

20. A method according to Claim 19, wherein the load applied to the wheel by the workpiece is detected by monitoring a current drawn to move the abrasive surface of the wheel relative to the workpiece.

21. A method according to Claim 19 or 20, wherein the load applied to the wheel by the workpiece is detected by monitoring a current drawn to rotate the wheel.

22. A method according to Claim 20 or 21, wherein said rate of advancing movement is reduced when said current is greater than a predetermined value.

23. A method according any of Claims 19 to 22, wherein the advancing movement is reversed when the detected load is greater than a predetermined value for a predetermined period of time.

24. A method of removing material from a workpiece, said method comprising the steps of:

rotating an abrasive wheel having an abrasive circumferential surface about a first axis passing through a centre thereof;

orbiting the wheel about a second axis spaced from the first axis;

effecting relative advancing movement between the second axis and the workpiece to remove material from the workpiece;

detecting a load applied to the wheel by the workpiece; and

reversing the advancing movement when the detected load is greater than a predetermined value for a predetermined period of time.

25. A method according to Claim 23 or 24, wherein the advancing movement is subsequently re-effected towards the workpiece when the detected load falls below a predetermined value.

26. A method according to any of Claims 19 to 25, wherein the magnitude of the detected load is monitored during the removal of material at each of a plurality of spaced positions along the workpiece.

27. A method according to Claim 26, wherein the positioning of the wheel in preparation for the removal of material from one of said spaced positions is controlled in response to wear of the wheel during the previous removal of material from at least two of said spaced positions.

28. A method according to Claim 27, wherein the extent of the wear of the wheel is detected from the relative positions of the wheel when the magnitude of the detected load reaches a predetermined value during said previous removal of material.

29. A method according to Claim 27 or 28, wherein the extent of the wear of the wheel is detected from the relative positions of the wheel when load applied to the wheel is first detected during said previous removal of material.

30. A method of positioning a tool in preparation for the removal of material from a workpiece, said method comprising the step of controlling the position of the tool in preparation for the removal of material from one of a plurality of spaced positions along the workpiece in response to wear of the tool as determined during the previous removal of material from at least two spaced positions along the workpiece.

31. A method according to Claim 30, wherein the load on the tool during the removal of material from said spaced positions along the workpiece is detected and the position of the tool in preparation for the subsequent removal of material from one of said spaced positions is controlled in response to wear of the tool as determined from the relative positions of the tool when load applied to the tool is first detected

during said previous removal of material from at least two spaced positions along the workpiece.

32. A method according to any of Claims 30 to 31, wherein the tool is rotated about an axis.

33. A method according to Claim 32, wherein said tool comprises an abrasive wheel.

34. A method according to Claim 33, wherein the wheel is orbited about a second axis spaced from said first-mentioned axis, and the second axis is moved relative to the workpiece to bring a circumferential edge of the wheel into contact with the workpiece.

35. A method according to any of Claims 23 to 25 and 34, wherein said predetermined period of time is at least one third of the time taken for the wheel to perform a full orbit of the second axis.

36. A method according to Claim 34 or 35, wherein the area of contact between the tool and the workpiece is decreased by decreasing said rate of advancement.

37. Apparatus for, or a method of, removing material from a workpiece substantially as herein described with reference to Figures 5 to 10 of the accompanying drawings.

38. Apparatus for, or a method of, positioning a tool in preparation for the removal of material from a workpiece substantially as herein described with reference to Figures 5 to 10 of the accompanying drawings.